A 7 Wechselwirkung von Materie mit Ionen

Zeit: Dienstag 14:30–16:00 Raum: H7

A 7.1 Di 14:30 H7

Sputtering of uranium dioxide and lithium fluoride by highly charged ions — •Hermann Rothard, Jerome Lenoir, Fabien Haranger, Thorsten Jalowy, Smail Boudjadar, Brigitte Ban dEtat, Philippe Boduch, Serge Bouffard, Amine Cassimi, Henning Lebius, Bruno Manil, and Laurent Maunoury — CIRIL-Ganil, BP5133, F-14070 Caen Cedex 05, France

Sputtering of uranium dioxide was studied at CIRIL-Ganil both at high energy in the electronic stopping power regime (MeV/u; NIMB141,1998,372), and with low-energy highly charged ions (q keV) where nuclear stopping is important. Further effects related to the high projectile charge (potential sputtering) can occur. Angular distributions and total sputter yields were measured by means of the catcher technique (Physica Scripta T110 (2004) 389) with Xe ions of different charge (q=1-25) and kinetic energy (1.5-81 keV). We have also measured the contribution of emitted (UOx)n clusters (n=1-7) by time-of-flight secondary ion mass spectroscopy (Eur. Phys. J. D32 (2005) 19). Furthermore, we applied the TOF-XY-imaging technique to ion-surface collisions in the two different velocity regimes, i.e. at 10 MeV/u (electronic stopping) and at low velocity (0.1 atomic units). This technique allows to study the momentum distribution of emitted secondary ions (velocity and angle). We present first results obtained with uranium dioxide and lithium fluoride.

A 7.2 Di 14:45 H7

Correlated electron emission in collisions of Krypton ions (64 MeV/u) with Carbon targets — •Hermann Rothard[1], Gaetano Lanzano[2], Enrico De Filippo[2], Siegbert Hagmann[3], and Claude Volant[4] — [1]CIRIL-Ganil (CEA/CNRS/ENSICAEN/Univ. de Caen), BP5133, F-14070 Caen Cedex 05, France — [2]INFN and Dipartimento di Fisica e Astronomia, Via S. Sofia 64, I-95123 Catania, Italy — [3]IKF, Univ. Frankfurt, D-60438 Frankfurt am Main, and GSI, D-64291 Darmstadt, Germany — [4]DAPNIA/SPhN, CEA/Saclay, F-91191 Gif-sur-Yvette Cedex, France

The large detector array ARGOS, initially designed for nuclear physics studies, was adapted for the study of electron emission in atomic collisions and used at GANIL and at LNS/Catania. We measured the angular dependence of binary encounter-, convoy-, and in-flight emitted projectile Auger electrons with a Kr beam (q=32 and 34, 64 MeV/u) traversing thin carbon foils at GANIL. A unique feature of the ARGOS multidetector is the possibility to measure the coincident emission of particles. Therefore, the correlated emission of electrons can be observed (Nucl. Instrum. Meth. B205 (2003) 841). We present preliminary results on electron-electron coincidences between three sets of electron detectors. Two of them were placed in forward direction in a plane on the left- and right- hand side of the beam, one of them perpendicular to this plane. Only for in-plane coincidences a peak is observed which seems to be related to an inelastic binary encounter with momentum transfer to an inner shell projectile electron. This is a particular ionization process involving a target and a projectile electron simultaneously.

A 7.3 Di 15:00 H7

New measurements on the Casimir-Polder force between a ^{3}He atom and a dielectric surface — •Lodewijk Arntzen — Physikalisches Institut Heidelberg, Philosophenweg 12, 69120 Heidelberg.

We measured the Casimir-Polder force between a ^{3}He atom and a variety of surfaces making use of quantum reflection. This force depends on the polarizability of the atom, and the dielectric function of the surface. Recently, we measured the retarded potential parameter C_4, of a ^{3}He atom and silicon while varying the temperature of the substrate between 300 and 1200 K. The dielectric function of a semi-conductor depends strongly on temperature. Experimentally, we find C_4 to change by a factor 1.6±0.016 in this range. In our analysis, we include a detailed model of the dynamic dielectric function of silicon, in order to extract the temperature dependence of the Casimir-Polder force from our data.

A 7.4 Di 15:15 H7

Energieverschiebung des Grundzustands von He-Atom vor einer Aluminium-Oberfläche — •Stephan Wethekam und Helmut Winter — Institut für Physik, Humboldt-Universität zu Berlin, Newtonstr. 15, D-12489 Berlin

He-Atome und -Ionen mit Energien von einigen keV werden streifend an einer sauberen, atomar ebenen Al(111)-Oberfläche gestreut und die resultierenden Winkel- und Ladungsverteilungen mit Hilfe eines ortsauflösenden Channelplates analysiert. Das System He-Al gilt als Modellsystem zum Studium der "Auger-Neutralisation", ein fundamentaler Ladungstransfermechanismus zwischen Atom und Festkörper. Geladene Projektile werden an der Oberfläche durch diesen Prozeß fast vollständig neutralisiert. Die Analyse der Verschiebung der Winkelverteilungen gestreuter geladener sowie neutraler Projektile bei Variation des Abstands der dichtesten Annäherung der Projektile an die Oberfläche (einstellbar durch Energie und Einfallswinkel) liefert die Verschiebung der He-Grundzustandsenergie als Funktion des Abstands zur Oberfläche. Als Folge der Wechselwirkung des He-Grundzustands mit dem Al-Leitungsband (Hybridisierung) zeigt sich eine ausgeprägte Abweichung von einem klassischen dielektrischen Verhalten, die für ein detailliertes Verständnis der mikroskopischen Wechselwirkungsprozesse von Atomen mit Festkörperoberflächen von großer Bedeutung ist.

A 7.5 Di 15:30 H7

Radiative Electron Capture to the Continuum Cusp (RECC) and the short-wavelength limit of electron nucleus Bremsstrahlung in inverse kinematics for 90 AMeV $U^{88+} + N_2$ — •M. Nofal[1,2], S Hagmann[3,2], C. Kozhuharov[2], T. Stöhlker[2], X. Wang[4], A. Gumberidze[2], U. Spillmann[2], R. Reuschl[2], S. Hess[2], S. Trotsenko[2], D. Banas[2], F. Bosch[2], D. Liesen[2], D. Jakubassa[5], M. Steck[2], P. Beller[2], K. Beckert[2], and B. Franczak[2] — [1]Max Planck Inst. f. Kernphysik, Heidelberg — [2]GSI-Darmstadt — [3]Inst. f. Kernphysik, Univ. Frankfurt — [4]Fudan University, Shanghai — [5]Rechenzentrum LMU-München

We have investigated for 90 AMeV $U^{88+} + N_2$ coincidences between cusp electrons around $v_{elec} \approx v_{Proj}$ analyzed with the imaging forward electron spectrometer in the ESR - and x-rays detected at 90° with respect to the beam axis. In the coincident x-ray spectra we see nearly exclusively photons from the short wave length limit of electron nucleus Bremsstrahlung, corroborating identification of the coincident electrons as RECC cusp. We found a strong asymmetry of the coincident RECC electron cusp distribution [1] which is skewed towards the high-energy side of the electron spectrum; we compare the RECC cusp with the non-radiative electron capture (ECC) and loss (ELC) cusp peaks in the forward electron spectrum.

[1] D.Jakubassa J.Phys.B36 (2003)1971

A 7.6 Di 15:45 H7

Charge state and energy loss by highly charged- decelerated heavy ions under crystal channeling conditions — •Angela Bräuning-Demian[1], Fritz Bosch[1], Harald Bräuning[2], Michel Chevallier[3], Camille Cohen[4], Denis Dauvergne[3], Alexander Gumberidze[1], Alain LHoir[4], Robert Kirsch[3], Christophor Kozhuharov[1], Dieter Liesen[1], Paul Mokler[1], Jean-Claude Poizat[3], Cedric Ray[3], Jean-Pierre Rozet[4], Thomas Stöhlker[1], Etienne Testa[3], Marcel Toulemonde[5], and Punita Verma[1] — [1]GSI , 64291 Darmstadt, Germany — [2]Institut für Atom- und Molekülphysik, Justus-Liebig Universität, 35392 Giessen, Germany — [3]Institut de Physique Nucleaire de Lyon, 69622 Villeurbanne cedex, France — [4]GPS, Universites Paris VI-Paris VII, 75251 Paris cedex 05, France — [5]CIRIL, 14040 Caen cedex, France

Ions channeled in a crystal are repelled by the aligned target atoms. Thus their interaction with matter is dominated by collisions at large impact parameter with the atoms, and to close collisions with the valence electron gas. The use of highly-charged, decelerated heavy ions such as U91+ ions at energies below 20 MeV/u leads to specific features for charge exchange and energy loss under channeling conditions. In particular, although these ions sample a reduced electron density, their energy loss rate is very high, due to the dependence of the stopping force on the square of the ion charge state Q. This contribution will report on recent results obtained at GSI.